3-19-1999

CropWatch No. 99-2, March 19.1999

Lisa Brown Jasa
University of Nebraska-Lincoln, ljasa@unlnotes.unl.edu

CROP WATCH

University of Nebraska Cooperative Extension
Institute of Agriculture and Natural Resources

No. 99-2
March 19, 1999

Options for cutting weed control costs

On the surface, cutting weed control costs sounds like a great idea. Everyone would like to save money in his/her operation; however, cutting costs may sound like cutting quality, which can lead to lost revenue. For most producers the bottom line is yield.

For a weed management program to reduce costs and remain viable, it has to provide for optimum yields. A cost/benefit analysis should be used to determine whether a proposed program would be cost efficient for a specific operation. Not all fields lend themselves to reduced cost weed management programs. In some cases, it may be important to reduce the cash outlay for weed control even if the total costs are not lower. An example would be to use a cultivator you already own instead of buying a herbicide. A reduction in herbicide expenditures is an area growers may examine to lower the immediate expenditure for weed control.

Cost cutting tips

• **Use less expensive herbicides.** Producers have several options for saving money with their herbicide applications, depending on which weed management program they use. For instance, in a conventional weed management strategy, using less expensive herbicides, including Atrazine and Extrazine, for preemergence applications may save money while still providing acceptable weed control. Remember to check local prices before deciding on a program.

• **Cultivate.** Another strategy may be to use a preemergence herbicide and save money by cultivating 30-40 days after emergence. This may reduce the expenditure for postemergence weed control.

• **Band herbicides.** Banding herbicides is another cost saving alternative that can reduce herbicide costs by one-third to two-thirds while providing very good weed control. Herbicide rates are calculated by dividing the band width by the row width and multiplying by the broadcast rate per acre. A timely cultivation is needed for weed control between the rows.

• **Roundup Ready strategy.** In a Roundup Ready system, using reduced rates of preemergence herbicides can save the producer several dollars per acre. (The Roundup application may be used to catch most escapes.)

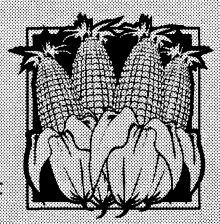
A study in Clay Center showed that Harness Xtra at the 1.3 qt/ac rate followed by 1.5 pt of Roundup provided equal weed control and yields as the 2.3 qt/ac rate followed by 1.5 pt of Roundup. In this study, not only did the reduced preemergence rate save money, the program allowed for performance equal to that of the higher preemergence rate.

• **Know the weed pressure.** Being very familiar with the weed pressure in a field can also save the producer money. For instance, if the grass pressure in a particular field has been low, there may be little reason to use a preemergence grass herbicide. Why? Annual grass seeds do not have a particularly long soil life in eastern Nebraska. Another example would be field edges. Many times, the field borders are much weedier than the field interior. These areas greatly misrepresent the field, causing the

(Continued on page 13)

King corn: Getting a good start

In 1998 Nebraska ranked third in the nation in corn for grain production with 1,239,750,000 bushels. This issue and the next issue feature stories related to corn production and early season issues.



Inside

Updates

Ralph Anderson, Extension Educator in Buffalo County: There's beet a lot of coffee shop talk about army cutworms, but few have been found so far and most of the talk is speculation. Fortunately, the sandhill cranes and sea gulls are also looking for these pests and may help with some infestations. With continuing reports from Kansas of army cutworms, we will be on the lookout for them.

Lower fertilizer prices are a pleasant surprise for many producers.

It has been a good winter for calving and many producers are making the midnight runs to the calving barns. Everything is looking good except prices!

Gary Hall, Extension Educator in Phelps and Gosper counties: Lots of NH_3 is being applied. Wheat and alfalfa is beginning new growth. With the recent warm temperatures, it won't take long for these crops to enter the full growing mode.

Paul Hay, Extension Educator in Gage County: Starter and broadcast phosphorus fertilization has been the topic of numerous calls to the Extension office this week. Especially this year, farmers need to be sure that the inputs they use will enhance yield beyond the total cost of the application. Yield is the ultimate goal so don't cut things that can help you reach your goal, but be sure to consider the costs and benefits when determining whether you need an application and how much to apply. For example, one farmer reduced his starter fertilizer application from 10 gal to 5 gal/acre and will cut costs by at least $1,400. Soil tests indicated this amount would be more than sufficient. By reducing the rate recommended the average savings to the farmer from the last five calls has been $1100 per farmer.

In another case, grid samples indicated phosphorus levels were adequate except in a few small areas of the field. Broadcast applying 100 lb of phosphorus to the whole field would be excessive.

Calendar

Scout wheat and alfalfa for army cutworms. *When:* now.

Put out wireworm bait stations in fields where you intend to plant corn to determine the potential for wireworm damage (see NebGuide G91-1023) *When:* next two-three weeks.

Get spraying equipment in condition. Fill with water, flush system, clean nozzles and screens, and calibrate. *When:* now.

Check stored grain. Run fans as necessary to keep grain within 10°F of exterior temperature. *When:* now.

Prepare planter. Check seed metering, drive chains, bearings, opening disks and any pesticide and fertilizer application equipment on it. Check to make sure desired rates are being applied. *When:* now.

Take aerial shots of bare soils (preferably after a 1/4 inch rain). Maps of yield, organic matter and other aspects can be compared with digitized photos. Shoot straight down using a camera with larger than a 28 mm lense. Do not use color infrared film. *When:* early spring.

CROP WATCH

In print or on the Web

Crop Watch is published from March to November by the University of Nebraska Institute of Agriculture and Natural Resources Communications and Information Technology, PO Box 830918, 108 Agricultural Communications Bldg., UNL, Lincoln, NE 68583-0918. To order either a printed or electronic (web) subscription or to change your address, write to ***Crop Watch*** at the above address or call (402) 472-7981. A sample copy of the Web version is available free at *http://www.ianr.unl.edu/cropwatchnews*

Lisa Jasa, Editor
Email: agcm005@unlvm.unl.edu

For more information about a particular subject, write the authors at the addresses below:

UNL Department of Entomology
202 Plant Industry Bldg.
Lincoln, NE 68583-0816

UNL Department of Plant Pathology
406 Plant Science Bldg.
Lincoln, NE 68583-0722

UNL Department of Agronomy
279 Plant Science Bldg.
Lincoln, NE 68583-0918

UNL Department of Agricultural Meteorology
236 L.W. Chase Hall
Lincoln, NE 68583-0728

Technology fee added to calculations

Weed management software updated, improved

For those of you familiar with WeedSOFT, the University of Nebraska software aiding in weed management decisions, it's no surprise that we listened to our customers and made the program even better for 1999.

WeedSoft, which is based on years of University and private research and experience, uses parameters such as economics and environmental impacts to help users select the best weed management strategy. The 1999 version incorporates several changes suggested by users.

WeedSOFT contains four modules:

- **EnviroFX** – a module containing valuable soil-herbicide interaction information;
- **MapView** – allows users to view several color-coded soil maps of Nebraska counties indicating soil vulnerability to herbicide use,
- **WeedView** – containing a database with several images of many popular Nebraska weeds, and
- **Advisor** – the bio-economic decision aid that calculates yield loss and recommends herbicide treatments based on expected yield and various point and click environmental information.

Most of the 1999 changes are in the *Advisor* section. Now users can right click over the toolbar icons for an information banner. Users also can enter a technology fee so *Advisor* can combine that fee in the final output. Users can enter any amount they wish for this fee, with $7/acre being roughly the standard for Roundup Ready technology. Third, the recommendation list as well as individual treatments can be printed. This allows users to more easily transfer information to clientele and aids in record keeping. Fourth, it is now easier to sort treatment recommendations based on percent maximum yield or net gain with highlighted headers suggesting the chosen sort option. Finally, as with each year, *Advisor* has been updated with a host of new treatments including Balance in corn, LeadOff in corn and sorghum and First Rate in soybeans.

To purchase the WeedSOFT program for the first time can, you can send a check for $185 + $10 shipping and handling to WeedSOFT, PO Box 830915, Lincoln, NE 68583-0915, or contact Jeff Rawlinson at 402-472-1544 for more information. Annual updates are $35 for WeedSOFT owners.

WeedSOFT will continue to be revised to make it more user friendly and provide more services.

Jeff Rawlinson
Extension Technologist

Cutting weed costs *(Continued from page 11)*

producer to apply more total product than is necessary. A cost saving alternative would be to apply heavier rates around the field perimeter and reduced rates within the field interior.

Disadvantages to these cost cutting strategies

Many of these scenarios will save the producer money while providing very good weed control; however, there are some drawbacks.

- **Banding takes time.** Banding preemergence herbicides can slow planting and requires cultivation. Relying on custom application also can reduce the feasibility of banding as very few custom applicators provide this option. Conflicts with other operations, such as no-till, also can remove banding as an option.
- **Soil moisture loss.** Cultivation has additional disadvantages, such as increasing soil erosion, wasting soil moisture and not being compatible with no-till systems.
- **Reduced product support.** With reduced rates, there are no product guarantees. You are on your own, good or bad. Using a reduced preemergence rate also makes a timely postemergence application more critical. If you were expecting four to six weeks residual control from a full rate, a reduced rate will probably only provide two to four weeks. Cultivating 35–40 days after planting will greatly reduce weed pressure, resulting in an economical and effective weed management strategy.

Alex Martin
Extension Weed Specialist
Jeff Rawlinson, Extension Technologist, Weed Science

Label updates

Continuous updating of the *1999 Crop Protection Reference*, sometimes known as the Greenbook from C&P Press, is available free on the Web at *www.greenbook.net*. The site includes more than 670 product labels from 23 sponsor companies. Worker protection information is summarized by product.

Early season insect control in corn; new products extend opportunities

Options for soil insect control are changing as new products become available. In addition, the trend toward earlier planting and increased residue cover has increased the need for managing seed and seedling attacking insects even in crop rotation systems.

Corn rootworm control in corn

Corn rootworms are still the most economically important insects in Nebraska. In some years other insects like the European corn borer may cause more yield loss, but each year more money is spent controlling rootworms since nearly all continuous corn acres are treated. Insecticides are applied as granular formulations at planting or cultivation time or as liquid formulations at planting or post emergence for larva control. Some farmers opt to kill adult beetles to prevent egg laying. These control methods can adequately protect yield potential when materials are applied properly, at the right time, and under normal environmental conditions. Environmental conditions can have a major impact on the performance of any control method.

The surest way to eliminate rootworm problems is through crop rotation. Rootworm problems in crop rotations are extremely rare. While some areas of east central Illinois and northwest Indiana may be experiencing problems with rootworms in strict corn-soybean rotations, this has not occurred in Nebraska. Isolated areas in Dixon and Cedar counties in northeast Nebraska have occasionally seen problems in strict corn-oats rotations. Establishing multi-crop rotations is a good first step in managing many pest problems.

Granular insecticides for rootworm control

Most granular insecticides are applied at planting. Provided that all materials are handled safely, the advantages of this method are the relative ease of application (most growers have insecticide boxes and know how to use them) and there is less worry about timing. In most years this control method provides adequate protection. In-furrow or banded applications perform similarly for rootworm control. Problems may occur when growers forget to calibrate application equipment (do this yearly regardless of whether the same product is used), high winds move the material away from the seed furrow or band, and environmental breakdown of materials increases due to early planting. Insecticide labels require that these materials should be incorporated with a chain or other soil disturbing device behind the press wheel. Any granules left on the soil surface will degrade rapidly and may cause harm to non-target animals. Rotate insecticides to reduce the chances of resistance. While there is some variation in performance from year to year, all registered insecticides will perform satisfactorily under most conditions.

Cultivation-time applications of granular insecticides usually provide somewhat better root protection than planting time applications, since the material is applied closer to rootworm egg hatch. (In Nebraska egg hatch normally occurs in late May through June.) Reduced insecticide rates often work well with this application time. Disadvantages are that extremely wet weather conditions may not allow application and corn may grow past the point of getting over it with a tractor or extremely dry conditions fail to activate the insecticide. There is increased advertising for use of certain soil insecticides for control of corn nematodes. To avoid unnecessary expense for control of nematodes, particularly in crop rotations, first confirm the presence and populations of nematodes with a soil test.

Liquid insecticides for rootworm control

A new insecticide, Regent 4SC (fipronil), formerly an 80 WG, is now being marketed for corn rootworm as well as first generation European corn borer control. It is also labeled for control of most other soil inhabiting insects. This liquid formulation is applied in-furrow at planting time, with either specially designed equipment or with pop-up fertilizer. It can be applied with as little as 1 gallon of carrier (water or fertilizer mix) per acre. Company representatives suggest that rootworm control will improve if the carrier application rate is 4 gallons per acre or higher. While Regent should be used primarily for corn rootworm control, it has shown systemic activity against first generation European corn borer. Field testing has shown variable results, with reduction of corn borer cavities ranging from 40% to 70%. Since it is a relatively new compound, we are still trying to determine the environmental and application factors that account for the variability. As a comparison, well timed treatments of standard first generation European corn borer insecticides can give 80-90% or more control.

Post emergence liquid formulations Lorsban 4E and Furadan 4F are other alternatives to granular applications. Chemigation of Lorsban 4E is popular with some growers. Furadan 4F applied by custom application or by the farmer has also gained a measure of acceptance. These products will perform best when application occurs shortly after egg hatch. Since timing is more critical than with granular applications, use a regular scouting program to determine when to apply. *Note:* Data from Nebraska trials indicates that post emergence applications of Furadan 4F when applied for optimum rootworm control will normally not protect against first generation European corn borer. Corn borers will still need to be managed with other methods.

In some areas of Nebraska, growers reduce damage

Corn insects *(Continued from page 14)*

from rootworm larvae by killing the adults in late July or early August. Well-timed applications prevent egg laying and an insecticide for larva control is not necessary the next year. Many programs are designed as multiple applications to control other insects as well, i.e. second generation European corn borer. In most areas of Nebraska this technique will work for rootworm management under a proper scouting program; however, mismanagement by repeated application of the same product has caused the onset of resistance to some materials applied to control adult beetles. (*See page 18.*)

Seed and seedling insect pests

Wireworms, seedcorn maggots, and white grubs have become an increasing concern for Nebraska farmers. While there may not necessarily be any greater populations of these insects than in the past, increased awareness has led many to believe the problem is more severe than it was several years ago. Also, a series of cool, wet springs in some areas of the state, combined with more conservation residue, have led to cooler soil temperatures and slower germination. This allows more time for these insects to find the seeds. It is necessary to plan to manage these insects because there are no rescue treatments. Since planting time insecticides usually control these insects, we normally don't worry about them in continuous corn. Usually these soil insect pests are rare in row crop rotations, and you don't necessarily need a seed treatment or soil insecticide unless there is a past history of problems in that particular field. Consider treatments:

1) When germination may be delayed due to adverse soil conditions such as wet and cool or dry soils. Early planted fields are more likely to fall into this category.

2) To protect new seedlings in fields with a history of seedling diseases or insects.

3) In seed production fields.

4) When planting at low and/or precise populations.

5) For fields previously in pasture or idled for several years.

Wireworms

Wireworms feed on the seeds and roots of corn, sorghum, small grains, grasses, soybeans, dry beans, sugar beets, potatoes, and various other root crops. Wireworm feeding may reduce seed germination or produce weak seedlings. Wireworms eat the germ of the seeds or hollow them out completely, leaving only the seed coat. Larvae boring into the underground (mesocotyl) portion of the stem cause seedlings to die or become stunted. Seed treatments will reduce damage to seed, but will not protect emerged plant parts. Under heavy infestations of wireworms a granular soil insecticide may be necessary. Bait stations may be used to assess levels of wireworm infestation before planting (NebGuide G91-1023). The bait consists of germinating corn and wheat (or oat) seeds. Substances produced by the seedlings attract the wireworms to the bait. Bait stations should be set up two to four weeks before the planned planting date. They should be placed randomly throughout the field with a minimum of ten stations per field. Be sure to place stations in different parts of the field (areas with different soil types, low or high spots, etc.) to obtain a representative sample. If you find an average of one or more wireworms per bait station, use an in-furrow application of a labeled soil insecticide. If wireworms are present at low levels (less than one per station), seed treatment alone should be sufficient to prevent serious damage.

Seedcorn maggots

Seedcorn maggots attack the seeds of many crops before or just at germination, preventing germination by killing the newly emerging coleoptile. Damage from seedcorn maggots can be prevented by using a seed treatment.

White grubs

White grubs feed on roots deeper in the soil. Crop emergence may appear normal in the beginning. Later the stand becomes thin or patchy. Roots of crops are usually chewed off cleanly. White grubs can only be controlled by granular soil insecticides.

The active ingredients in seed treatments are permethrin (newly labeled), lindane and/or diazinon for insect control and a fungicide (i.e. captan, maneb, carboxin) is often included to inhibit seedling diseases. Most have graphite included for smooth flow. While the graphite enhances flow, problems have been experienced with the graphite building on seed monitors of air/vacuum planters. To prevent this buildup some manufacturers have talc products to add to the mix. Results have been mixed.

Normally once there is an established row crop rotation with good weed control, seed attacking insect populations are relatively low and a seed treatment will give stand protection equal to that of a soil insecticide at much less cost ($1-$1.50 an acre for seed treatment vs $16-$20 for a soil insecticide). In most cropping situations, a seed treatment is the best economic return over the long term. It is excellent for seedcorn maggot protection and most wireworm situations. For farmers with air planters or those who do not like working with the dusty conditions produced by seed treatments, two products — Raze (tefluthrin) and Assault (permethrin) — can be applied to the seed in a liquid slurry before planting by a commercial applicator. Availability is somewhat limited since most seed is ordered well in advance of planting season. This would be more expensive than a regular seed treatment.

Seed treatments come in packets, 1 lb bags, 5 lb bags or 10 lb bags. For corn, generally the rate used is 4 oz of product per 100 lb of seed. Under very hot conditions or with the use of poor quality seed, the lindane in some of these products may cause seed injury. Also, incomplete mixing of the insecticide in the planter box may cause seed

(Continued on page 16)

Spring nitrogen applications allow time to assess wheat stands

Most winter wheat grown in Nebraska requires some additional nitrogen fertilizer for profitable wheat production. This is true for virtually all soils in Nebraska where wheat is commonly grown unless there is a large carryover of fertilizer nitrogen. Residual fertilizer nitrogen can be measured effectively with a residual soil nitrate test of the root zone. While depth of the root zone for wheat is often six feet or more, most available nitrogen affecting yield is in the top two or three feet of soil. The producer can sample from less than the top three feet, but the resulting recommendations will be slightly less accurate.

Topdressing nitrogen on wheat in spring offers a significant advantage because it allows the producer to evaluate yield potential based on stands and soil moisture before investing in an application. Topdress fertilizer prior to jointing. Yield response to later nitrogen application decreases, although grain protein content generally increases.

Table 1: Optimum amount of nitrogen to apply based on residual nitrate in the soil to a depth of three feet. (The producer should refer to NebGuide G91-1000, *Guidelines for Soil Sampling*, for suggestions on taking soil samples). Recommendations in pounds of nitrogen to apply per acre are shown for two nitrogen prices (15 cents and 25 cents per pound of nitrogen) and two wheat prices ($2.50 and $3.00 per bushel). If the producer does not obtain a soil sample, he should use the recommended 8 ppm of nitrate-N per acre. This represents an average or medium soil nitrate level.

		Wheat price ($/bushel)			
		$2.50		$3.00	
Residual Nitrate-N (3-feet soil sample)		Fertilizer price ($/pound of N)			
Avg. ppm	Pounds N/acre	$0.15	$0.25	$0.15	$0.25
		Optimum nitrogen pounds per acre			
2	22	106	77	113	89
4	44	85	56	92	68
6	65	64	35	71	47
8	87	42	13	50	26
10	108	21	0	29	5
12	130	0	0	7	0

The producer should remember to subtract any nitrogen applied last fall from these recommendations.

The optimum nitrogen rate for winter wheat is calculated according to the following equation, where *N PRICE* is the price of nitrogen fertilizer in dollars per pound; *WHEAT PRICE* is the price of wheat in dollars per bushel, and NO_3-*N* stands for the average ppm NO_3-N in the top three feet of soil.

Wheat nitrogen rate (pounds/acre) = ((NITROGEN PRICE / WHEAT PRICE) + 0.014558 x NO_3-N - 0.235) / -0.00138

All fertilizer nitrogen sources [(ammonium nitrate (33-0-0); urea (45-0-0); urea-ammonium-nitrate UAN (28-0-0); and anhydrous ammonia (82-0-0)] are generally very effective for spring nitrogen fertilization. Ammonium nitrate, which is least susceptible to nitrogen losses due to volatilization, is the preferred nitrogen fertilizer for topdressing when incorporation is impossible. With incorporation soon after application all nitrogen sources should be equally effective. The most economical source of nitrogen that fits the restriction of the particular wheat production system should be used.

Jurg Blumenthal, Soil Fertility/Nutrient Management Specialist, Panhandle REC, Scottsbluff

Corn insects *(Continued from page 15)*

to be exposed to higher than labeled rates, which may cause reduced germination. Follow label directions carefully for use. Several companies offer these products under various trade names. Most local ag-chem dealers carry seed protectant products. Seed dealers also may have these products. Permethrin products Pounce 3.2 EC (4 to 8 oz in-furrow) and Pounce 1.5 G (8 to 16 oz per 1000 row feet) have received a 2EE label (Emergency Exemption) for use in Nebraska and Missouri to control wireworms, sod webworms and seedcorn maggots. We have little data on Pounce use for control of seed and seedling insects but we believe at the rates labeled they will perform well. **No current seed treatments will control corn rootworms.**

Some farmers are using reduced rates of granular or liquid insecticides in-furrow as a substitute for seed treatments. Unfortunately, we have very little data on comparing reduced rates of soil insecticides with seed treatments for seed and seedling insect control. If you use less than the labeled rate of a soil insecticide, the manufacturer is not obligated to compensate you for loss.

Keith Jarvi, Integrated Pest Management Extension Assistant, Northeast REC, Norfolk
Bob Wright, Extension Entomologist, South Central REC, Clay Center

Trend points to below normal precipitation

Below normal precipitation across the western two-thirds of Nebraska since late September has resulted in undesirable soil moisture levels for the upcoming growing season. A strong La Nina event is contributing to drier than normal conditions across most of the state, a trend expected to continue into early summer.

In the past five months, there have been only three periods of above normal precipitation: October through mid November, the first 10 days of January, and the last week of February through the first week of March. Outside of these periods, precipitation was virtually nonexistent. Only the October through November period produced precipitation across the state.

An examination of the precipitation records from October through February shows some clear trends. South central, central and the western half of east-central Nebraska have received 70-80% of normal precipitation. The Panhandle, north-central, and southwest have received 100-120% of normal precipitation, while southeast and northeast Nebraska received normal precipitation.

Since mid November, the western two-thirds of the state has received less than 50% of normal precipitation. This trend is of particular concern because it appears to coincide with the time when the La Nina event strengthened off the coast of Peru. Numerical models indicate that this event should continue into late May or early June before dissipating.

Much of the heavy snow this winter fell on eastern Nebraska, while seasonal snowfall across the western two-thirds of the state are less than 50% of normal. Seasonal snowfall totals across eastern Nebraska are near normal. While there is still time for a late season heavy snow, the odds of this happening are rapidly diminishing. It appears that the next two weeks will bring warm, windy conditions with little chance of precipitation. If the current precipitation pattern continues, Nebraska should expect dry conditions for the next four weeks.

Precipitation during the growing season following a La Nina event is typically below normal across Nebraska, with the southern half of the state most vulnerable to dry conditions. Below normal conditions have the highest correlation during the first half of the growing season. The area is likely to gradually return to a more normal precipitation pattern the latter half of the season.

If this pattern follows similar La Nina events of the past, wheat and pastures may be most vulnerable and sorghum growers may have reason to cheer; however, there is still a considerable amount of time left before the spring planting season begins in earnest and conditions could change dramatically. We don't want to alarm readers, but it is necessary to point out to subscribers that soil moisture profiles and precipitation trends will not be beneficial to Nebraska grain producers if they continue into the near future.

Conditions are being monitored by committees established by the Legislature to help mitigate the effects of climatic events on agricultural interests. Updates and recommendations from these committees will be shared with *CropWatch* subscribers as conditions warrant.

Al Dutcher
State Climatologist
Agricultural Meteorology

Aerate stored grain to avoid losses

With spring weather coming, producers need to check the temperature and condition of grain stored in their bins. We have received reports of flat grain storage without aeration has crusted. Much of this grain may have been stored in November and December when temperatures were warmer than usual and the grain may not have been cooled properly before or during winter storage.

Whether holding wet grain for a short time or storing dry grain for longer periods, it is important to control grain temperature. The grain mass needs to be monitored throughout the year, at least every three to four weeks in winter, and every two weeks in summer. Aeration fans should be run periodically during the storage period to keep the grain at a seasonally cool temperature, within 10 F of the average monthly ambient air temperature.

Maintaining this temperature should minimize moisture migration during storage. Air convection currents of warm air rising and cool air falling cause moisture migration problems in bins of improperly cooled grain (*see figure*). During winter, the warm air in the grain rises in the center of the bin. When the moisture-laden air contacts cold grain near the top center of the bin, condensation occurs.

Problems caused by this moisture movement often become obvious in the spring when outside air temperatures begin to warm. The first indication of trouble is

(Continued on page 19)

Researchers trace rootworm insecticide resistance in south central Nebraska

Dates of various events in each study are shown below.

Location /year	*Planting date*	*Rootworm egg hatch at Clay Center*	*Cultivation treatments applied*	*Root evaluation*
Holdrege/1997	April 24	June 9	June 11	July 23
Holdrege/1998	April 24	May 26	June 2	July 7
Aurora/1998	April 27	May 26	June 3	July 14

Reports from south central Nebraska of decreased adult rootworm control with foliar insecticides led to a series of studies beginning in 1994. This research has documented the presence of insecticide resistant western corn rootworms in two areas near York and Holdrege. UNL entomologists, in cooperation with USDA-ARS scientists from the Northern Grain Insects Laboratory in Brookings, S.D., have been researching the distribution of resistant beetles in Nebraska, the underlying mechanisms responsible for resistance, and management recommendations for areas with resistant corn rootworms.

UNL entomologists have been studying resistance as it influences control of larval and adult rootworms. This article addresses their research on larval resistance. The second part (scheduled to appear in the April 2 *Crop Watch*) will discuss results of the adult resistance research.

Larval resistance

Since most soil insecticides used against larval rootworms are either organophosphates (same class as methyl parathion) or carbamates (same class as carbaryl), it's possible that larvae from areas with adult resistance also would be resistant to these insecticides. Laboratory studies documented that larvae from areas with resistant adults are also harder to kill with some insecticides, however larval resistance levels were not the same for all organophosphate insecticides. Field studies have been conducted annually since 1996 to determine performance of soil insecticides against resistant rootworms.

Field studies: To further evaluate the response of corn rootworm larvae to soil applied insecticides, two field trials were conducted in 1997 in commercial corn fields at sites previously identified as having rootworm beetles with resistance to methyl parathion, based on laboratory bioassays. One site was near Gresham (York County) and one was near Holdrege (Phelps County). Overhead sprinkler irrigation was used at both sites. Due to low levels of rootworms at the York County site, only data from Phelps County will be reported. In 1998, similar studies were conducted near Aurora (Hamilton County) and at the same farm near Holdrege as the 1997 research.

Plots were 30-foot single rows which were replicated four times in a randomized complete block design. Cultivation treatments were applied shortly after rootworm egg hatch was detected at Clay Center. After most of the larval feeding had occurred (mid-July), five plants were dug from each plot, and roots were washed and rated for rootworm injury using the Iowa 1-6 root damage scale. (See *Evaluating Corn Rootworm Soil Insecticide Performance*, NebGuide G1108, for a description of this scale).

In 1997, there was relatively high rootworm pressure at the Holdrege site; the untreated plots averaged 4.55 on the 1-6 scale. Traditionally, a rating of 3 or less has been considered commercially acceptable control. At Holdrege, three insecticides applied at planting (Counter, Lorsban and Aztec) provided statistically similar levels of root protection, and were the best treatments in this study. All three contain organophosphate insecticides as the active ingredient; however, Aztec is a combination of an organophosphate and a pyrethroid insecticide.

In 1998, there was lower rootworm pressure at both locations. At Holdrege, all planting and cultivation time treatments, except for Furadan 4F, and Force 3G applied at cultivation time, were significantly better than the untreated check, but were not significantly different from each other. At Aurora, Counter 20CR applied at planting and Counter 15G applied at cultivation were the only two treatments that were significantly different than the untreated check. The 1998 results at Holdrege suggest that if rootworm larval pressure is moderate, many commercially available soil insecticides will provide similar levels of root protection, even against a resistant population.

Management recommendations

People using soil insecticides in areas with insecticide resistant rootworms should consider the following options:

- Crop rotation is highly effective in controlling rootworms in Nebraska and has the added benefit of not increasing the selection for insecticide resistance.
- Base the decision to use insecticides on the level of rootworms present in individual fields, based on adult scouting and economic thresholds (see NebGuide G774)

(Continued on page 20, related table on page 19)

Corn rootworm soil insecticide trial, 1997-1998, University of Nebraska-Lincoln

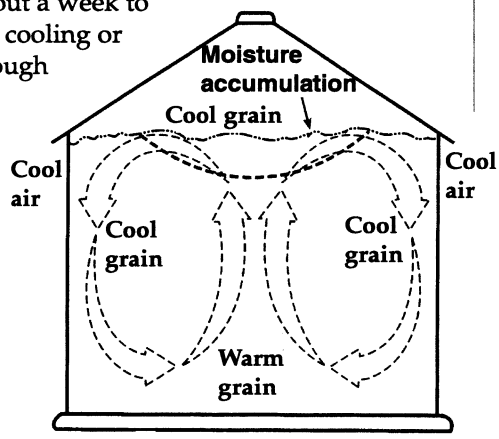
Product	*Product rate*	*Timing*	*Placement*	*Root injury rating (1-6 scale)* *Holdrege 1997*	*Holdrege 1998*	*Aurora 1998*
Counter 20CR	6 oz/1000 row-ft	Planting	TB	2.50 a	2.30 c	3.00 d
Counter 15G	8 oz/1000 row-ft	Planting	TB	2.55 a	-	-
Force 3G	4 oz/1000 row-ft	Planting	IF	3.75 cde	-	-
Force 3G	4 oz/1000 row-ft	Planting	TB	-	2.40 c	3.35 cd
Fortress 5G	3 oz/1000 row-ft	Planting	IF	3.40 cd	-	-
Fortress 2.5G	6 oz/1000 row-ft	Planting	IF	-	2.60 c	3.45 bcd
Aztec 2.1G	6.7 oz/1000 row-ft	Planting	TB	3.15 abc	2.55 c	3.60 bcd
Regent 80WG	2.6 oz/acre	Planting	IF	3.55 cd	2.75 bc	3.65 abc
Dyfonate 15G	8 oz/1000 row-ft	Planting	TB	3.35 bcd	-	-
Lorsban 15G	8 oz/1000 row-ft	Planting	TB	2.65 ab	2.47 c	4.25 a
Counter 15G	8 oz/1000 row-ft	Cultivation	Basal	3.40 cd	2.40 c	3.00 d
Force 3G	4 oz/1000 row-ft	Cultivation	Basal	4.00 def	3.30 ab	3.25 cd
Dyfonate 15G	8 oz/1000 row-ft	Cultivation	Basal	3.65 cde	-	-
Lorsban 15G	8 oz/1000 row-ft	Cultivation	Basal	3.85 cdef	2.80 bc	3.85 abc
Furadan 4F	2.5 oz/1000 row-ft	Cultivation	Foliar	4.35 ef	3.65 a	3.80 abc
Untreated	----------	----------	-------	4.55 f	3.55 a	3.65 abc
Untreated	----------	----------	-------	----	3.90 a	4.05 ab

Treatments sharing a letter in common are not statistically different, based on analysis of variance and multiple range test, p=0.05.
TB=T-band; applied in 7" band applied over open furrow in front of press wheel; IF=infurrow; applied directly into open furrow
Furadan 4F was applied at 30 psi and 15 gal per acre spray volume.
Regent WP was applied at 10 psi and 1 gal per acre

Stored grain *(Continued from page 17)*

usually damp or tacky feeling kernels at the grain surface, followed by formation of a crust. Moisture also moves by vapor diffusion from warmer to cooler areas in the bin. If grain temperature is not properly maintained during winter storage, there is a tendency for moisture to move to the cool grain along the bin sidewall, causing spoilage. Producers should check both areas for potential problems. If discovered in time, the crust can be broken up and the aeration fan turned on to dry the grain in the area of moisture accumulation.

A cooling or warming zone can be moved through the grain using aeration fans. The rate of movement depends on both the airflow rate (cfm/bu) and the hours of fan operation. For example, with an airflow of 0.1 cfm/bu it takes about a week to completely move a cooling or warming front through the grain mass, whereas with an airflow of 0.75 cfm/bu, it takes about a day. When the fan is running, the producer should check the exhaust air for any off-odors which may indicate mold growth or spoilage.



For grain drying questions

A team of Extension faculty are available to answer public questions regarding grain storage this year. They are Tom Dorn, Extension Educator from Lansaster County, 441-7180, and Dave Keith, Extension Entomologist, 472-8918. In addition, through a joint agreement with Kansas State University, Joe Harner, KSUagricultural Extension engineer for livestock and grain systems, will be addressing some questions at their request.

Producers should also use a grain probe to check the grain mass for non-uniform temperatures, high moisture pockets or layers, molds, and insects. Keeping the temperature below 50°F as long as possible will help minimize insect activity and increase the chances of getting through the summer without fumigating the grain. Problems should be corrected as soon as possible to prevent deterioration and possible serious economic loss. Consult NebGuides G94-1199, *Management to Maintain Stored Grain Quality*, and G84-692, *Aeration of Stored Grain*, for more information on grain storage, temperature management, and aeration.

Paul Jasa, Extension Engineer, UNL
Keith Jarvi, IPM Extension Assistant

Treat weeds in alfalfa before green-up

In the next few weeks as winter's snow melts away, this year's alfalfa crop will begin greening up In some areas, this may already be occurring. Now is the time to control winter annual weeds such as pennycress, mustards, and downy brome that lower yields, reduce quality, lessen palatability, and slow hay drydown. After alfalfa greens up, controlling these weeds is much more difficult, if even possible.

For alfalfa stands established one year or more, several herbicides may be used for weed control before alfalfa breaks dormancy.

Diuron 80 DF at 1.5–3.0 lb/a will provide excellent control of tansy mustard with good control of pennycress and some activity on downy brome.

Gramoxone Extra will have very good activity on downy brome at 1.5–2.0 pt/a. Do not cut or harvest for 42 days after application.

Lexone/Sencor and Sinbar at 0.5–1.0 lb/a can be used to provide excellent control of downy brome, pennycress and tansy mustard, as well as many other broadleaf weeds. Caution should be taken on soils with less than 1% organic matter because injury could result. Do not cut or harvest for 28 days after application.

A spring application of **Roundup Ultra RT** at 8–12 oz/a will do well on the downy brome and tansy mustard, but can only be applied to dormant alfalfa. Do not use additional surfactant or AMS and allow 45 days before harvesting.

Velpar at 1–1.5 qt/a will do an excellent job of controlling downy brome and broadleaf winter annuals. The one quart rate should be used for low organic matter soils.

Zorial Rapid 80 at 1.25–2.5 lb/a will do well on winter annual grasses with limited activity on tansy mustard. The lower rate should be used on sandy soils and 28 days should be allowed for harvest. Crop rotations should be noted and followed.

For controlling weeds in seedling alfalfa or alfalfa that has been established for one year, several herbicides will do well.

For limited control of broadleaf winter annuals, **Butyrac 200** (2,4-DB) at 1–3 qt/a can be used, providing alfalfa is in the 2-4 trifoliate leaf stage. This treatment should not be used if the temperature is expected to fall below 40° F within three days after application. Do not use treated forage for 60 days on new stands and 30 days on established stands.

Poast will provide good grass control at 1–2 pt/a, but will not control over-wintered downy brome.

Select at 6–8 oz/a also will provide very good grass control.

Pursuit DG at 1.08–2.16 oz/a will do very well on field pennycress and tansy mustard, as well as many other broadleaf weeds. Alfalfa should be in the second trifoliate stage at time of application. After the alfalfa has been established for one year or longer, Pursuit may be applied at any time. Allow 30 days for use of forage or harvesting.

The key for good weed control is to make the herbicide application before alfalfa greens up. After alfalfa breaks dormancy, weed control options are limited. Pursuit remains a very good treatment once alfalfa breaks dormancy with contact and residual weed control. Grass control can also be had with Poast or Select after dormancy.

On newly seeded stands, **Buctril** at 1–1.5 pt/a will provide average control of winter annuals. Applications should be made when the majority of alfalfa has four trifoliate leaves. Buctril should be used when temperatures remain under 70° F to reduce crop injury. Buctril will have limited activity of pennycress and tansy mustard that have overwintered. Allow 30 days after treatment before harvest.

Jeff Rawlinson, Extension Technologist Weed Science
Alex Martin
Extension Weed Specialist

Rootworm resistance *(Continued from page 18)*

• Resistant rootworm larvae do not respond similarly to all organophosphate insecticides. Based on 1997 research at Holdrege, planting time applications of Lorsban, Counter and Aztec provided adequate levels of root protection against a moderate to heavy rootworm population at a location known to have adult resistance to methyl parathion and carbaryl

• If using soil insecticides, do not use less than labelled rates for rootworm control.

• Whether you use adult control or soil insecticides, do not use the same insecticide in a field over several years

People in areas outside of the resistance area should consider the following practices to decrease the potential for insecticide resistance to develop:

• Rotate some corn acres.

• Whether you use adult control or soil insecticides, do not repeatedly use the same insecticide in successive years.

• Base the decision to use insecticides on the level of rootworms present in individual fields, based on adult scouting and economic thresholds. (See *Western Corn Rootworm Soil Insecticide Treatment Decisions Based on Beetle Numbers*, NebGuide G774)

Robert Wright, Extension Entomologist, South Central REC, Clay Center
Lance Meinke, Associate Professor
Blair Siegfried, Associate Professor
Both with the Department of Entomology